

## Does the Chinese mitten crab change its environment? An experimental approach

### Chinese mitten crab

*Eriocheir sinensis* is an invasive species that lives predominantly in freshwater but migrates seawards to breed. According to fishermen, the population of Chinese mitten crab in Lake Zuidlaardermeer, in the Northern Netherlands, has increased dramatically during the last decade.

### Management interest

In concordance with the European Water Framework Directive a good ecological water quality is a management goal. In the present ecosystem description of shallow lakes, this generally requires the stimulation of submersed vegetation and a reduction of populations of bream. The presence of large numbers of crabs might interfere with this goal.

Furthermore, Chinese mitten crabs are considered a time-consuming nuisance by fisherman using fykes and lines. Especially during migration, crabs become a large portion of the catch and may damage the catch too.

Finally, crabs dig holes in the shore line and are said to cut young shoots of emerging plants. This may be a cause of deterioration of the vegetated shore line.

### Experimental setup

Small mesocosms were created with 30 litre of water, a pot with reed canary grass *Phalarus arundinacea* (as emerging shoreline vegetation), a piece of 10 centimeter of pondweed *Elodea nuttallii* (as submersed vegetation), a shallow bowl with a mixture of sand and silt (as bottom sediment) and a plastic tube (diameter 10 cm, length 11 cm) as a shelter for crabs and fish.

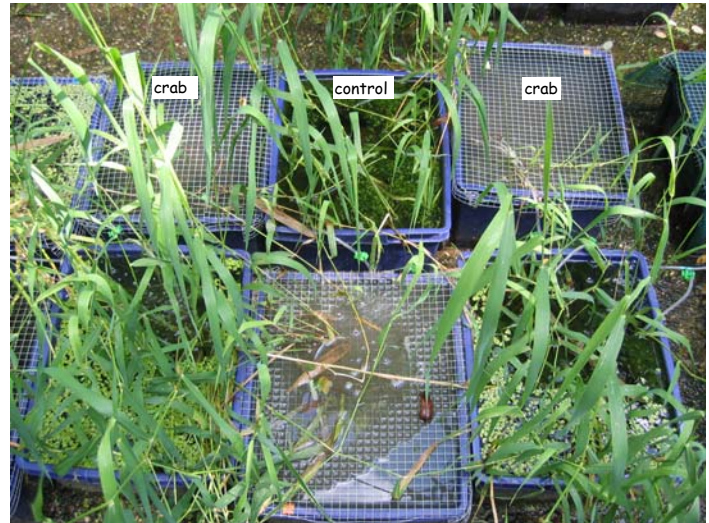
On 1 June 2004, a Chinese mitten crab *Eriocheir sinensis* (carapax width 3.0 cm) or a common bream *Abramis brama* (total length 11.1 cm) was added to half of the mesocosms. The other half of the mesocosms were kept as control.

A little bit of food was added to all mesocosms three times a week. Filamentous algae and floating plants (Duckweed, *Lemna spec.*) occurred unplanned. Every week from week 6 onwards, turbidity and cover of Lemna was estimated for each mesocosm.

On 12 October 2004, all plants and animals were harvested from each mesocosm. Plant material was dried and weighed and the size of the animals was measured. A comparison is made between pairs of mesocosms. Each pair exists of a control (without crab or fish) and a mesocosm with a crab or fish added. At harvest, due to mortality of crab and fish, the experiment involved six pairs with a crab and two pairs with a fish. Only these mesocosms are used in the analysis.

### Variables under study

- Biomass of emerging shoreline vegetation at harvest  
gram dry weight per mesocosm
- Biomass of submersed vegetation at harvest  
gram dry weight per mesocosm
- Occurrence of filamentous algae at harvest  
yes=1/no=0
- Cover of floating vegetation over the experimental period  
as percentage, n=8
- Turbidity over the experimental period (n=13)  
scored in classes from 0 (clear) to 3 (turbid)



The difference between mesocosms with and without Chinese mitten crabs. Note the differences in turbidity, submersed and emerging plants.

### Results

The table shows the average values and their standard error. Differences are tested as a pair wise t-test, significance shown as p-values.

	Pair wise comparison		Pair wise comparison	
	Crab (4.6 cm)	Control	Fish (11.8 cm)	Control
Emerging vegetation	5.3 ± 2.3	12.4 ± 2.7 p=0.09	8.4 ± 1.6	19.0 ± 1.2 p=0.16
Submersed vegetation	0.0 ± 0.0	11.6 ± 2.9 p=0.01	3.0 ± 1.1	14.0 ± 6.6 p=0.30
Filamentous algae	0.0 ± 0.0	0.5 ± 0.2 p=0.08	0.5 ± 0.5	0.5 ± 0.5 p=n.a.
Floating vegetation	0 ± 0	35 ± 16 p=0.07	50 ± 31	13 ± 13 p=0.30
Turbidity	1.5 ± 0.2	0.0 ± 0.0 p=0.001	0.2 ± 0.0	0.1 ± 0.1 p=0.21

### Conclusions

The Chinese mitten crab has a strong effect on the occurrence of plants. Submersed plants, floating plants and filamentous algae were absent in mesocosms with crabs. Emerging shoreline vegetation was reduced by 43%.

The mesocosms containing the crabs became quite turbid, which can also have indirect effects on the growth of submersed vegetation. The mesocosms containing a fish showed similar effects on the vegetation and turbidity but less in magnitude. The results suggest that the Chinese mitten crab has larger effects on plants and turbidity than bream of 11-12 cm.